Digital Logic Design Laboratory

Lab 5

Demultiplexers

Full name: …………………………………………….

Student number: ………………………………….

Class: ……………………………………………….......

Date: …………………………………………………....

# I. Objectives

In this laboratory, students will study:

- Understand and design a multiplexer.

- Use a demultiplexer and design/implement a circuit based on a function definition.

- Design combinational circuits using DEMUX.

# II. Procedure

1. Design demultiplexer using logic gates

a. Design 1-to-2 demultiplexer using logic gates:

A 1-to-2 demultiplexer has I is the input, S is the selector input, and Y1 and Y2 are two outputs. When S = 0 then Y0 = I but when S = 1 then Y1 = I. The Figure 1 shows the illustration of DEMUX 1-2.

Diagram, schematic

Description automatically generated

Figure 1. The illustration of DEMUX 1-2.

Built the truth table:

|  |  |  |  |
| --- | --- | --- | --- |
| Input | | Output | |
| S | I | Y0 | Y1 |
| 0 | 0 |  |  |
| 0 | 1 |  |  |
| 1 | 0 |  |  |
| 1 | 1 |  |  |

The expressions:

Implement the circuit via simulation software and paste the result in here

Make comment on the results

b. Design 1-to-4 DEMUX using logic gates.

Build the circuit. The inputs S0, S1, I, are driven by 6 switches. The outputs Y0, Y1, Y2, Y3 are connected to LED.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Input | | | Output | | | |
| S1­ | S0 | I | Y0 | Y1 | Y2 | Y3 |
|  |  |  |  |  |  |  |
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The expressions:

Implement the circuit via simulation software and paste the result in here

Make comment on the results

c. Design 1-to-4 DEMUX using 3 DEMUX 1-2.

Implement the circuit via simulation software and paste the result in here

Make comment on the results

2. Investigate IC 1-to-8 DeMultiplexer (74HC238)

Construct the circuit as below:

Diagram, schematic

Description automatically generated

Figure 2. IC 1-to-8 DeMultiplexer (74HC238)

- 8 outputs are connected by using LEDs.

- The inputs are controlled by switches.

- Observe the results and fulfill the truth table

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| INPUT | | | OUTPUT | | | | | | | |
| S2 | S1 | S0 | Y0 | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |
| 0 | 0 | 0 |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 |  |  |  |  |  |  |  |  |
| 0 | 1 | 0 |  |  |  |  |  |  |  |  |
| 0 | 1 | 1 |  |  |  |  |  |  |  |  |
| 1 | 0 | 0 |  |  |  |  |  |  |  |  |
| 1 | 0 | 1 |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 |  |  |  |  |  |  |  |  |
| 1 | 1 | 1 |  |  |  |  |  |  |  |  |

Implement the circuit via simulation software and paste the result in here

Briefly describe the operation of the IC

3. Design 1-bit Full Subtractor

a. Using logic gates

Construct the circuit as below:

Three inputs are A, B, Bin. Two outputs are D and Bout.

Build the truth table and the expressions

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Input | | | Output | |
| A | B | Bin | D | Bout |
|  |  |  |  |  |
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The simplified expressions:

Implement the circuit via simulation software and paste the result in here

Make comment on the results

b. 1-to-8 DeMultiplexer (74HC238)

Implement the circuit via simulation software and paste the result in here

Make comment on the results

4. Design 4-bit Full Adder using 74HC283 and display to BCD Seg

Construct the circuit as below:

Four inputs for A(A3, A2, A1, A0) and B(B3, B2, B1, B0). The outputs are display by BCD 7seg

Diagram

Description automatically generated

Implement the circuit via simulation software and paste the result in here

Make comment on the results